United States Patent [19]

Ellis et al.

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[45] **Date of Patent: Jan. 6, 1987**

[54] **CAPPING HEAD**

[75] Inventors: **Darwin L. Ellis; Frank M. Kelly,** both of Richmond, Ind.

[73] Assignee: **Aluminum Company of America,** Pittsburgh, Pa.

[21] Appl. No.: **792,579**

[22] Filed: **Oct. 29, 1985**

[51] **Int. Cl.**[4] **B67B 1/06;** B65B 7/28

[52] **U.S. Cl.** **53/331.5;** 53/317

[58] **Field of Search** 53/331.5, 317, 306, 53/362, 367, 368

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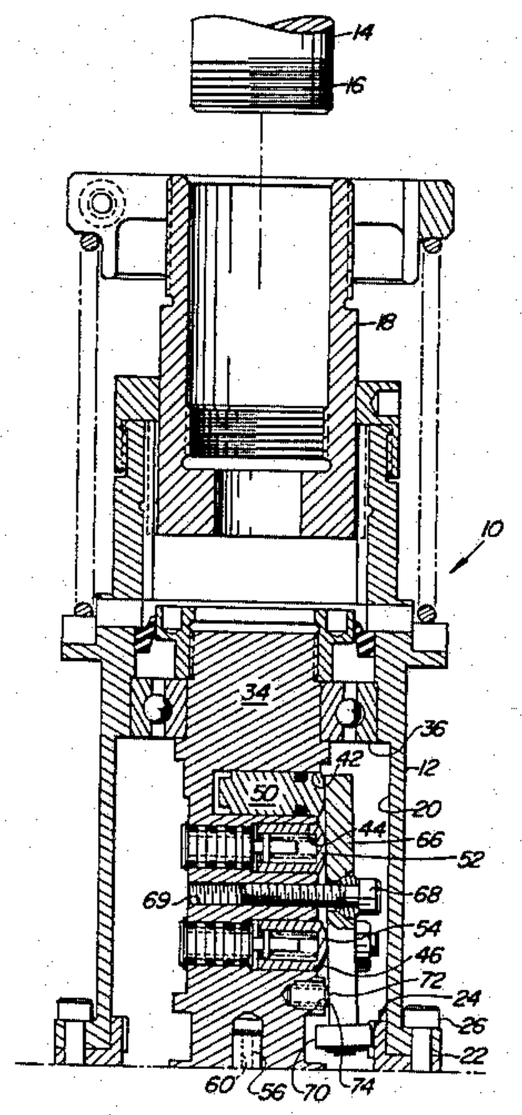
Primary Examiner—Horace M. Culver

Attorney, Agent, or Firm—Thomas J. Connelly

[57] **ABSTRACT**

A capping head for screwing a prethreaded closure onto a container provided with a screw thread. The capping head includes a housing adapted to be secured to a rotatable drive spindle and having a bore formed therein which is open at one end. A quill is mounted in the housing for free rotation therewith. The quill contains two radial bores which house a pair of poppet valves. The capping head also includes a torque-dependent clutch having a drive plate secured to the housing and a driven plate secured to the quill. The clutch is constructed such that it will stop screwing a prethreaded closure onto a container once a desired, predetermined torque value is reached. A chuck is attached to the driven plate and is fluidly activated between an open and closed position by the poppet valves. An activating arm is also present which is attached to the quill and cooperates with a cam formed on an inner peripheral surface of the housing to selectively operate the poppet valves when the torque value between the drive plate and the driven plate exceeds the desired, predetermined value.

22 Claims, 17 Drawing Figures



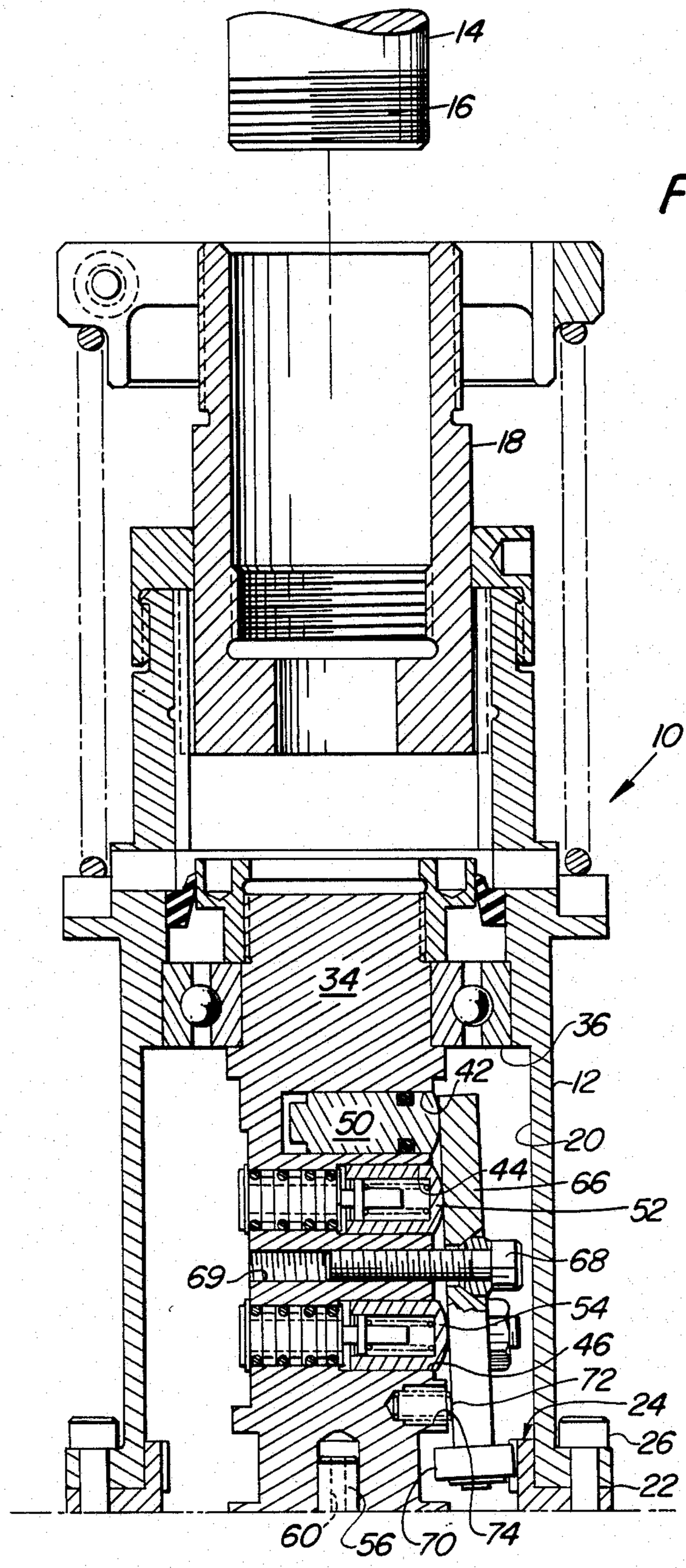

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Fig. 1a

Fig. 1b

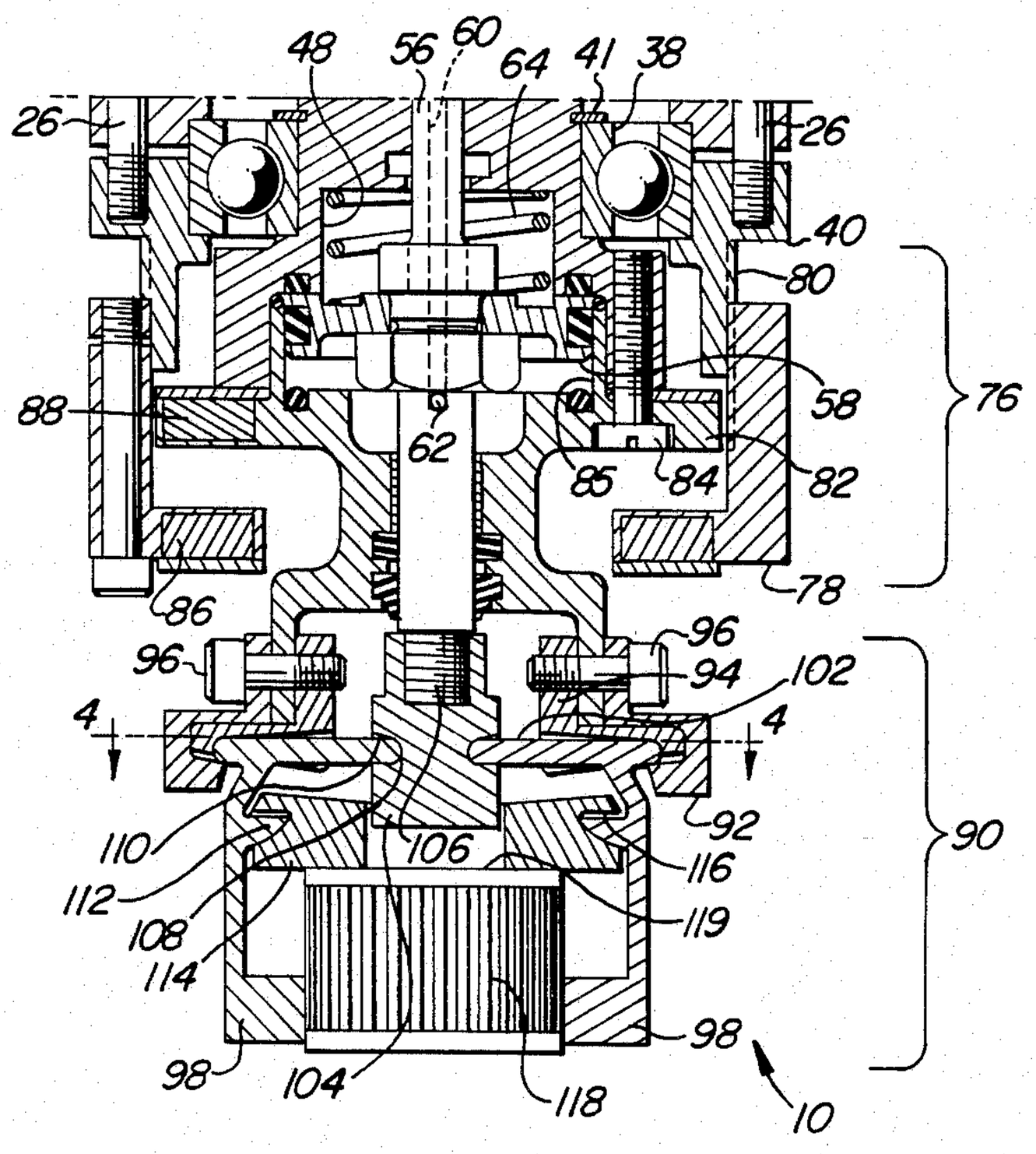


Fig. 2

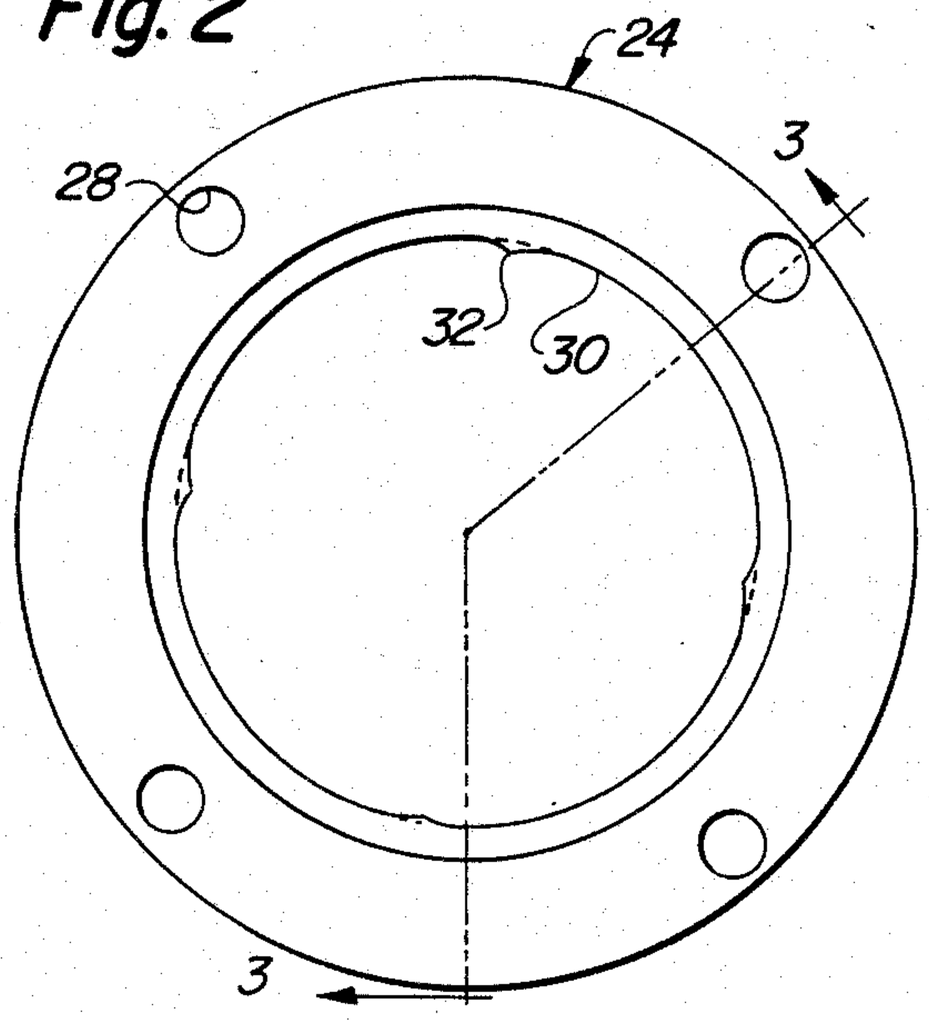


Fig. 3

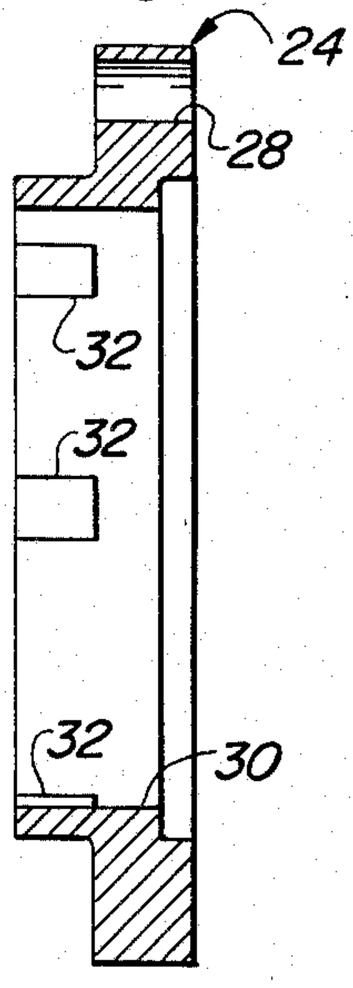


Fig. 4

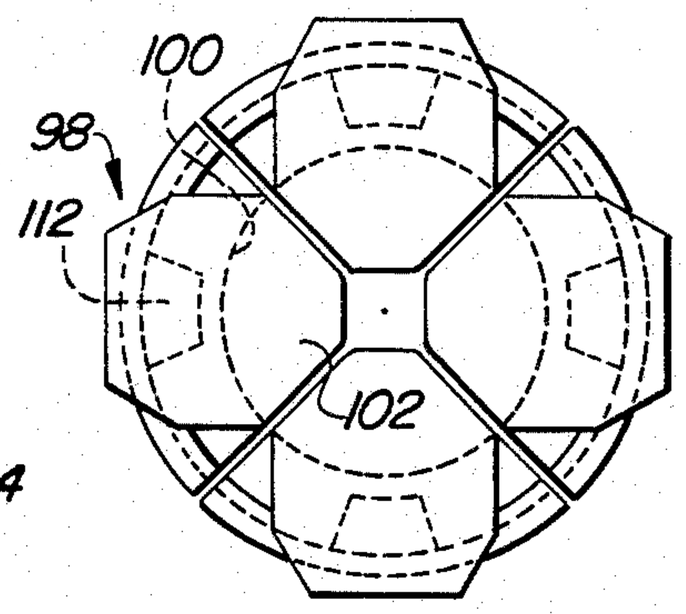


Fig. 6

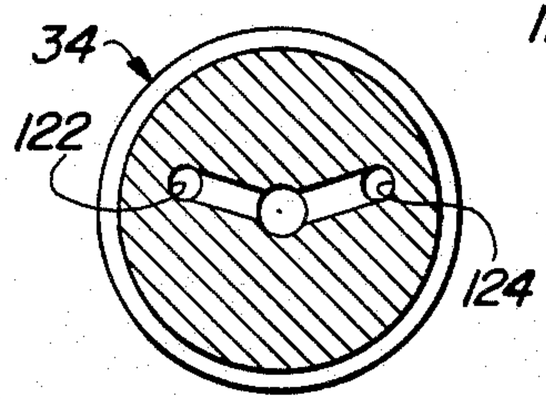
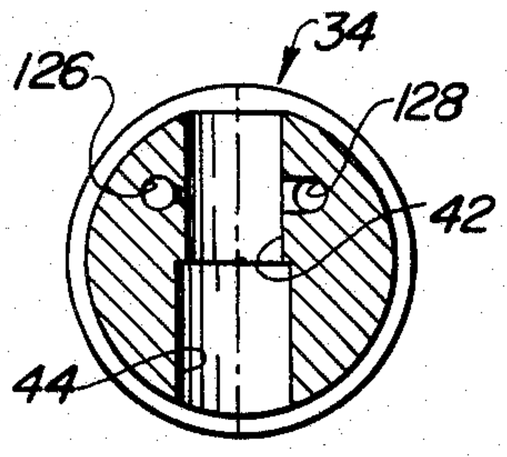


Fig. 8



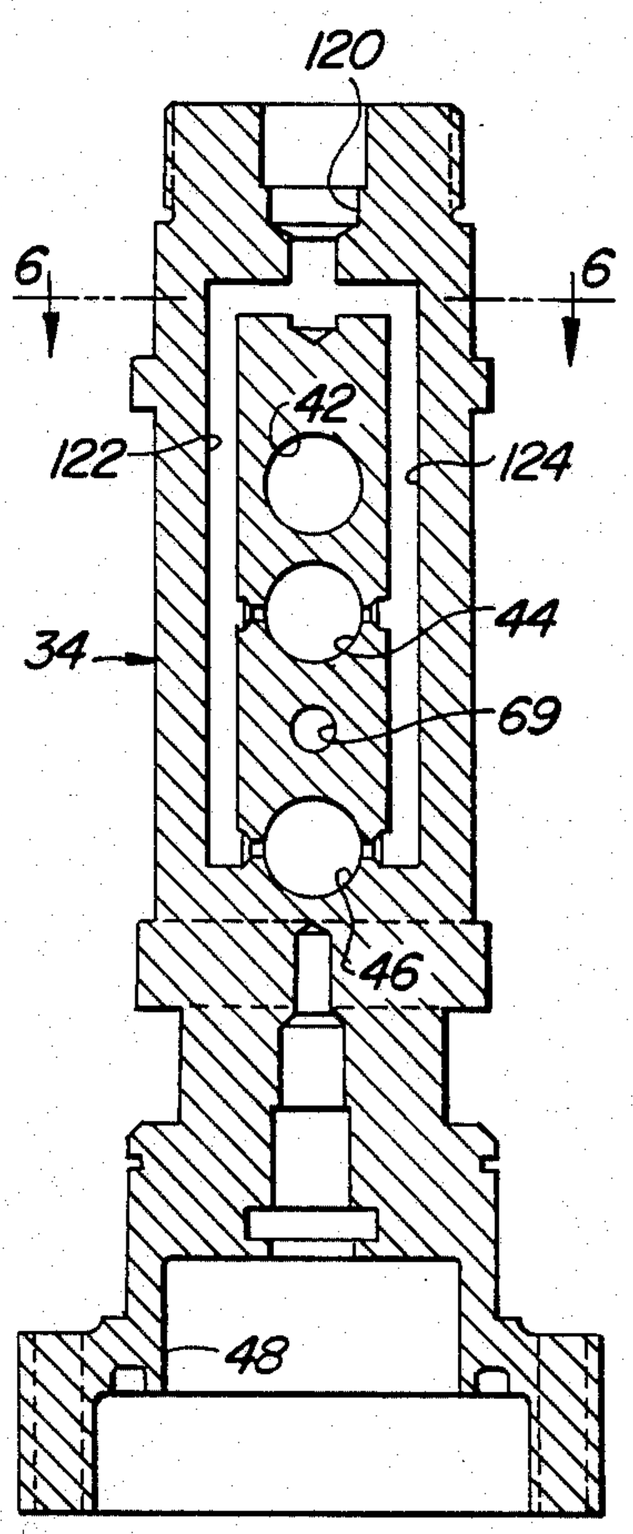


Fig. 5

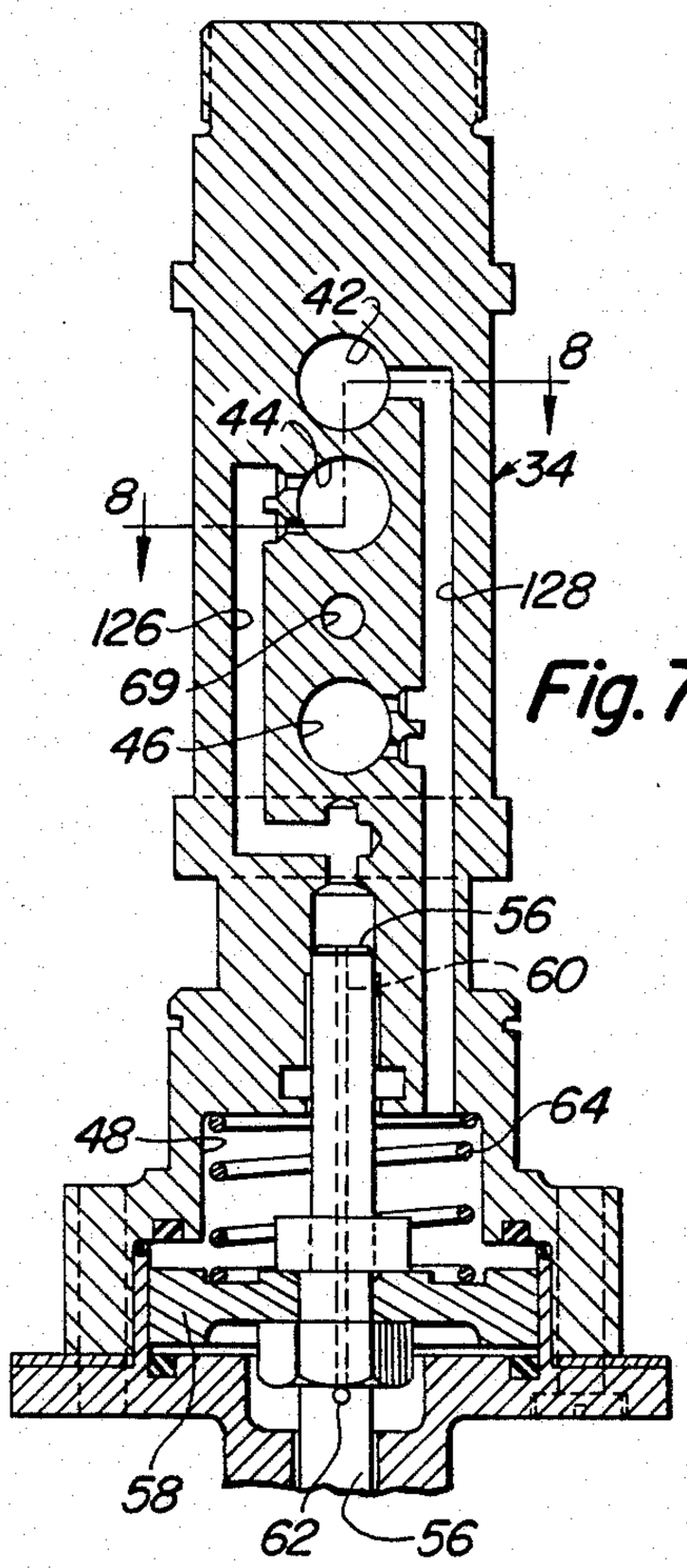


Fig. 7

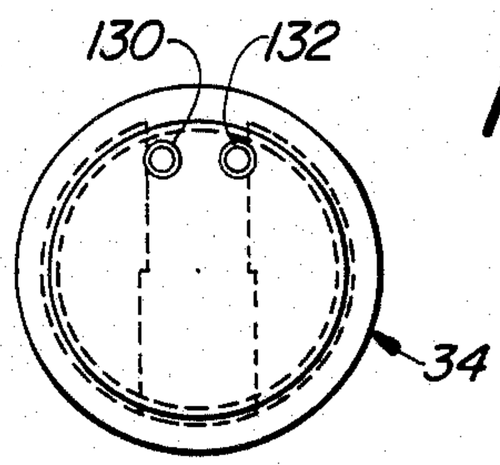


Fig. 10

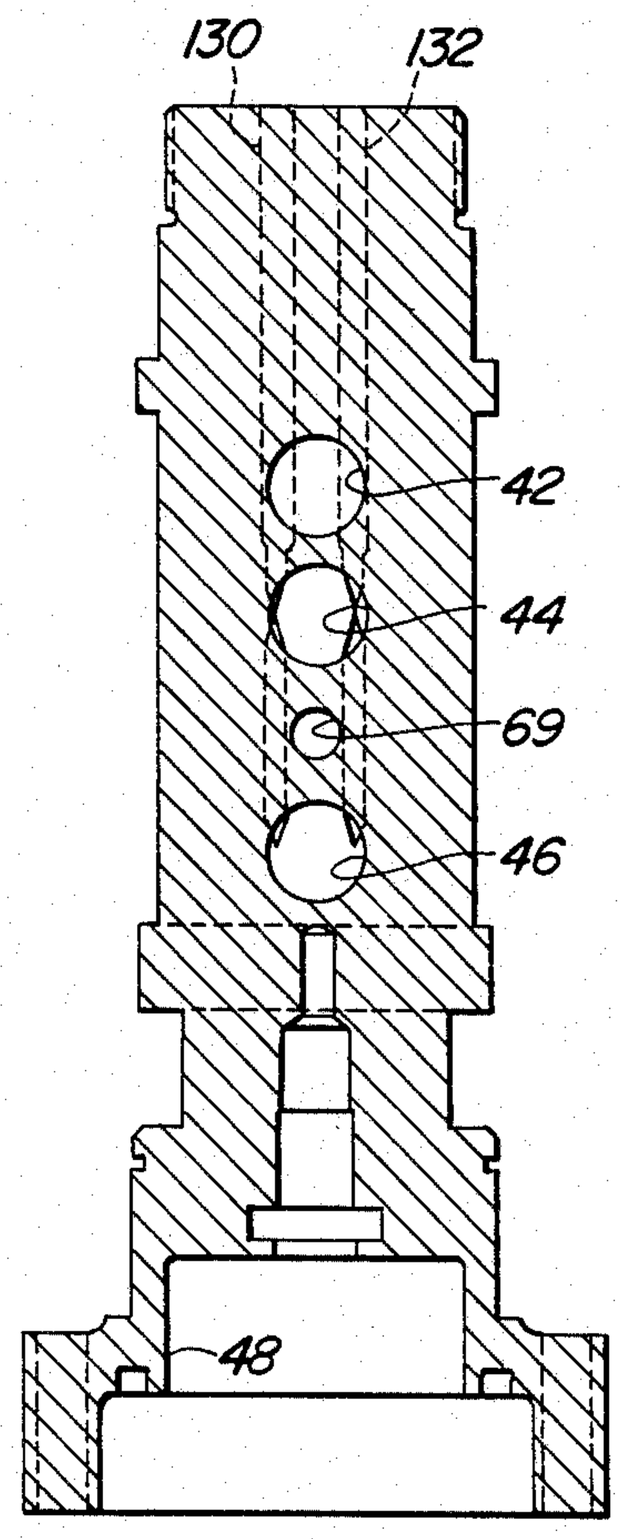


Fig. 9

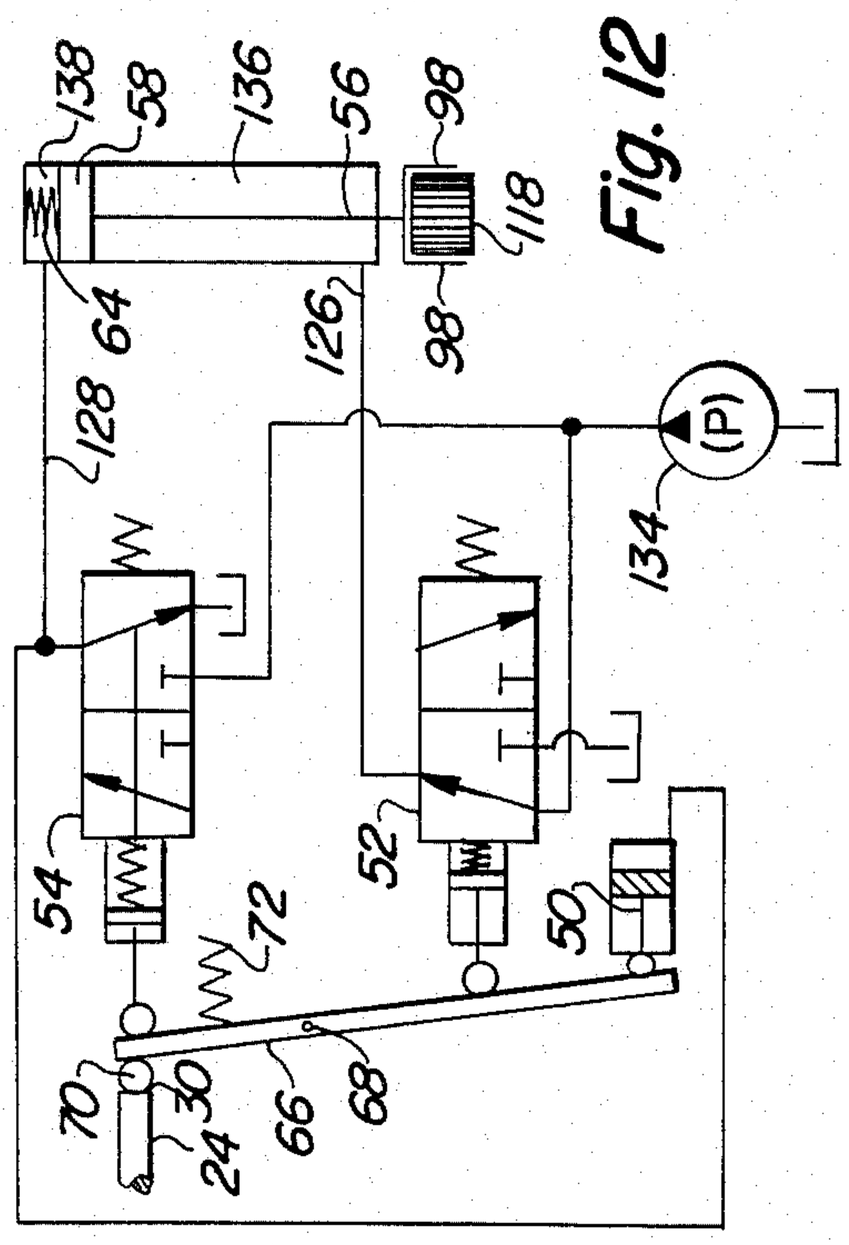


Fig. 12

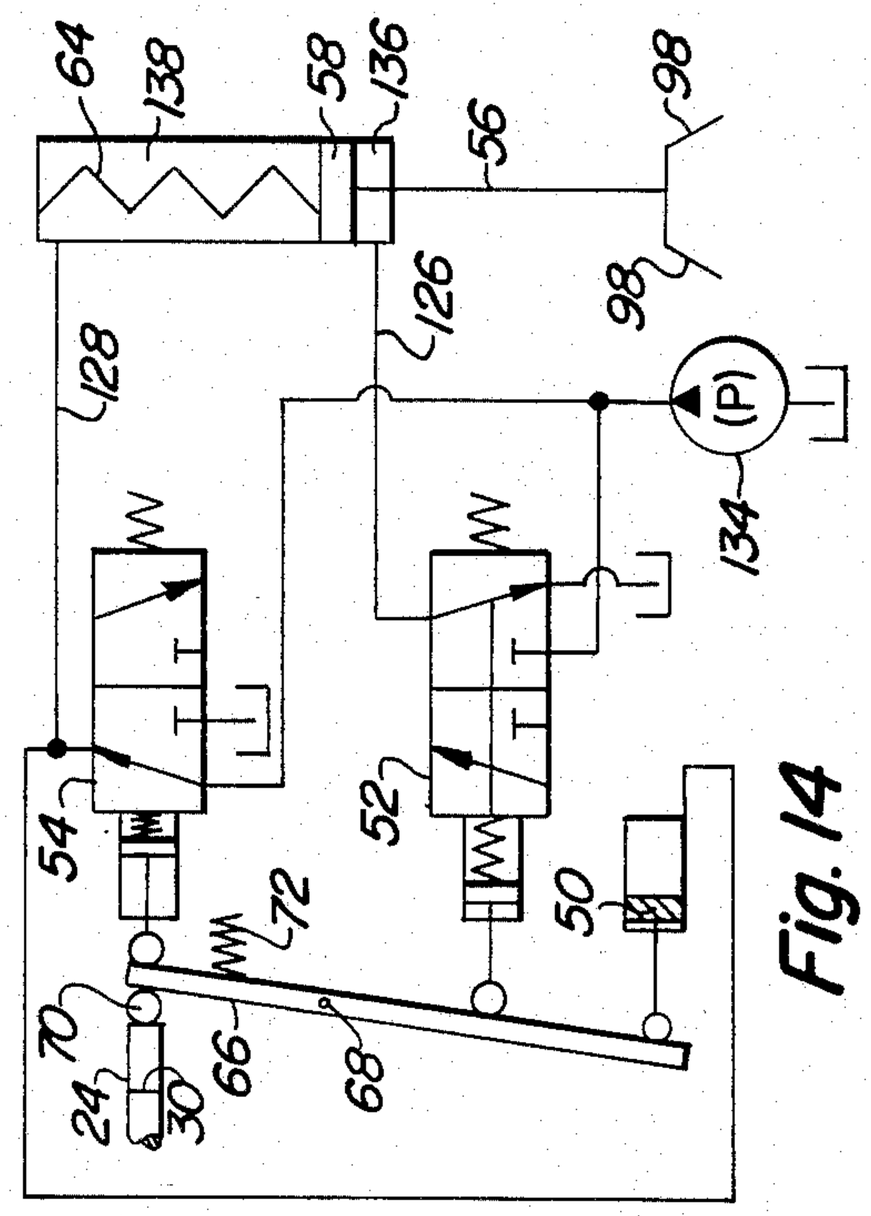


Fig. 14

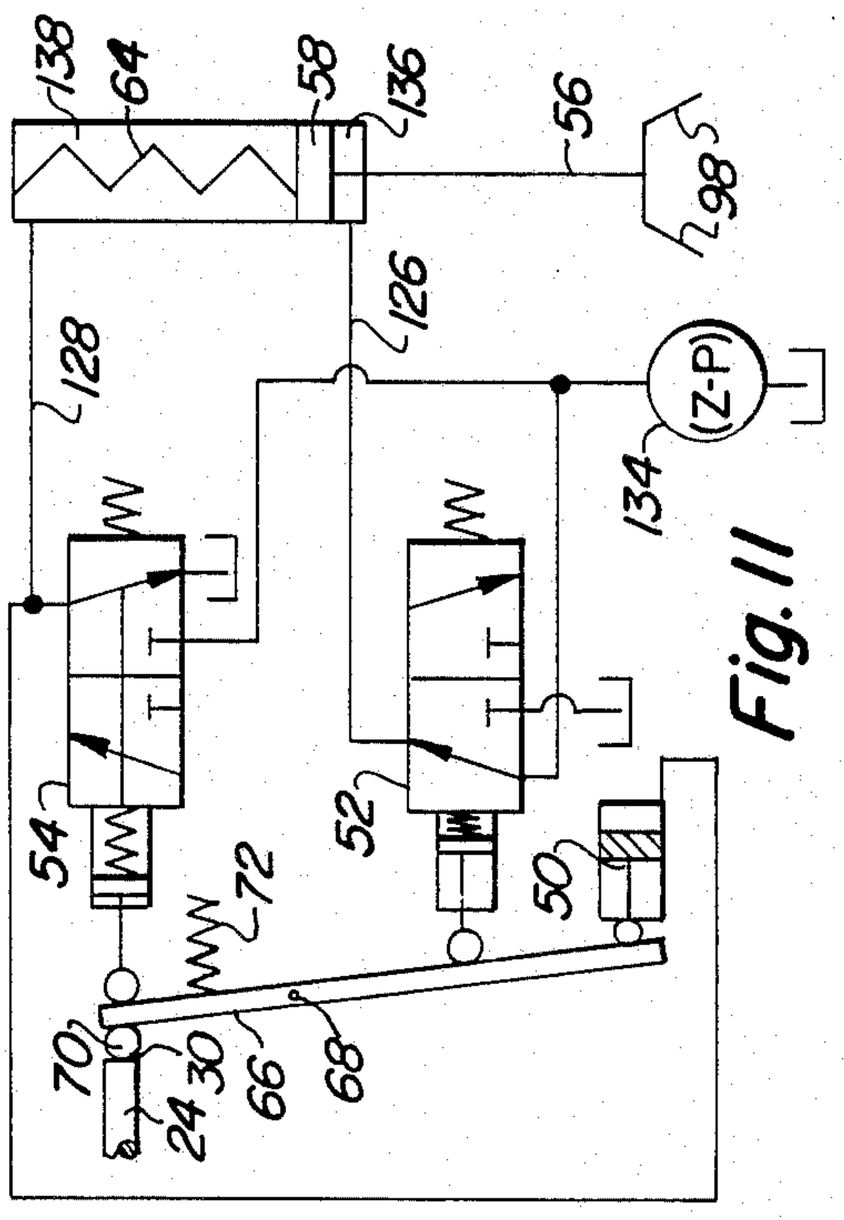


Fig. 11

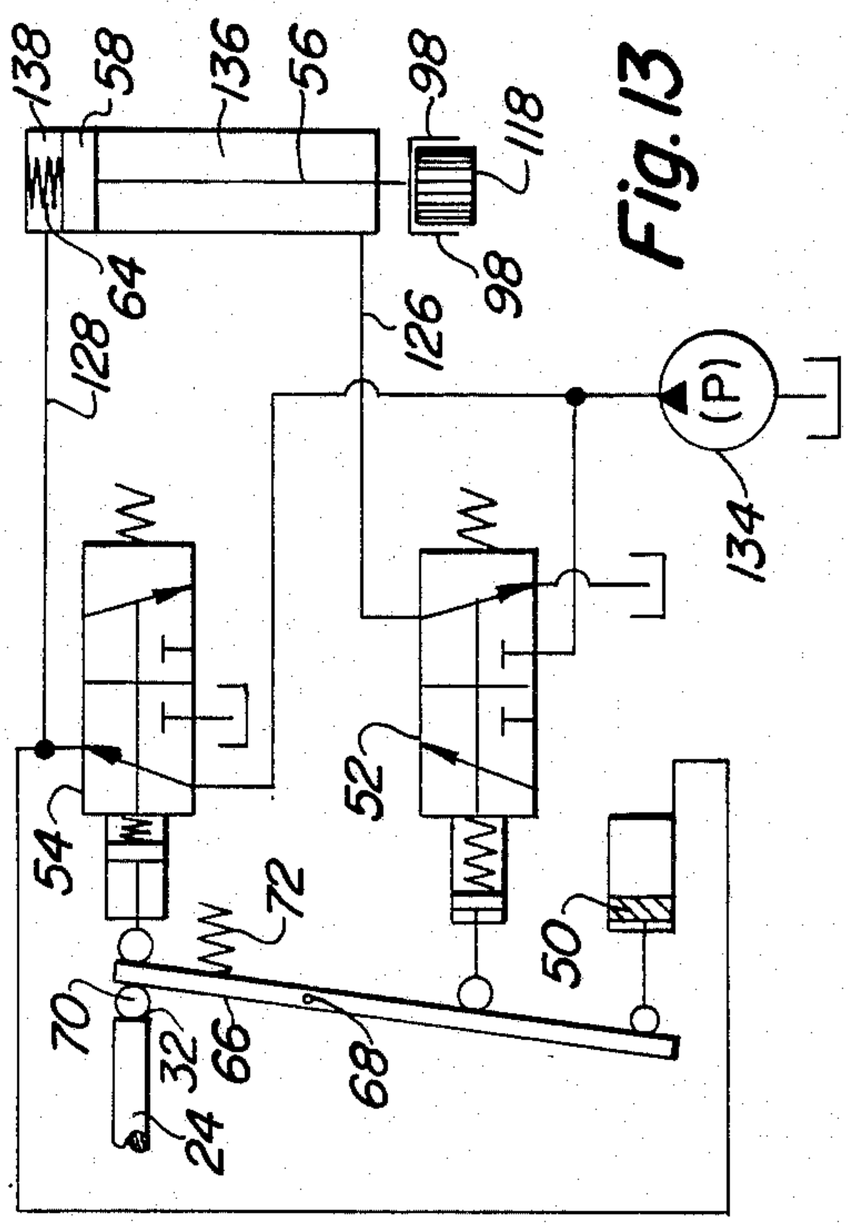


Fig. 13

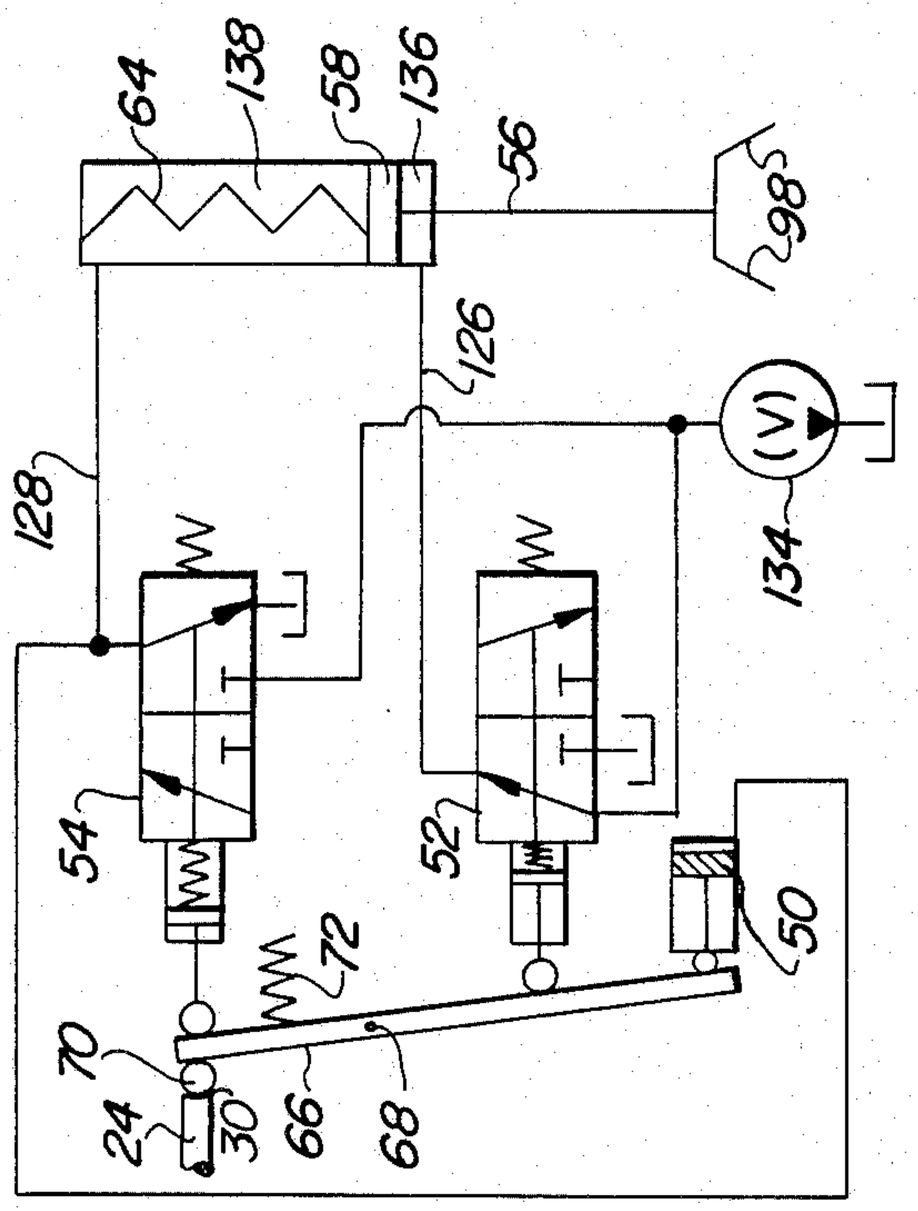

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Fig. 16

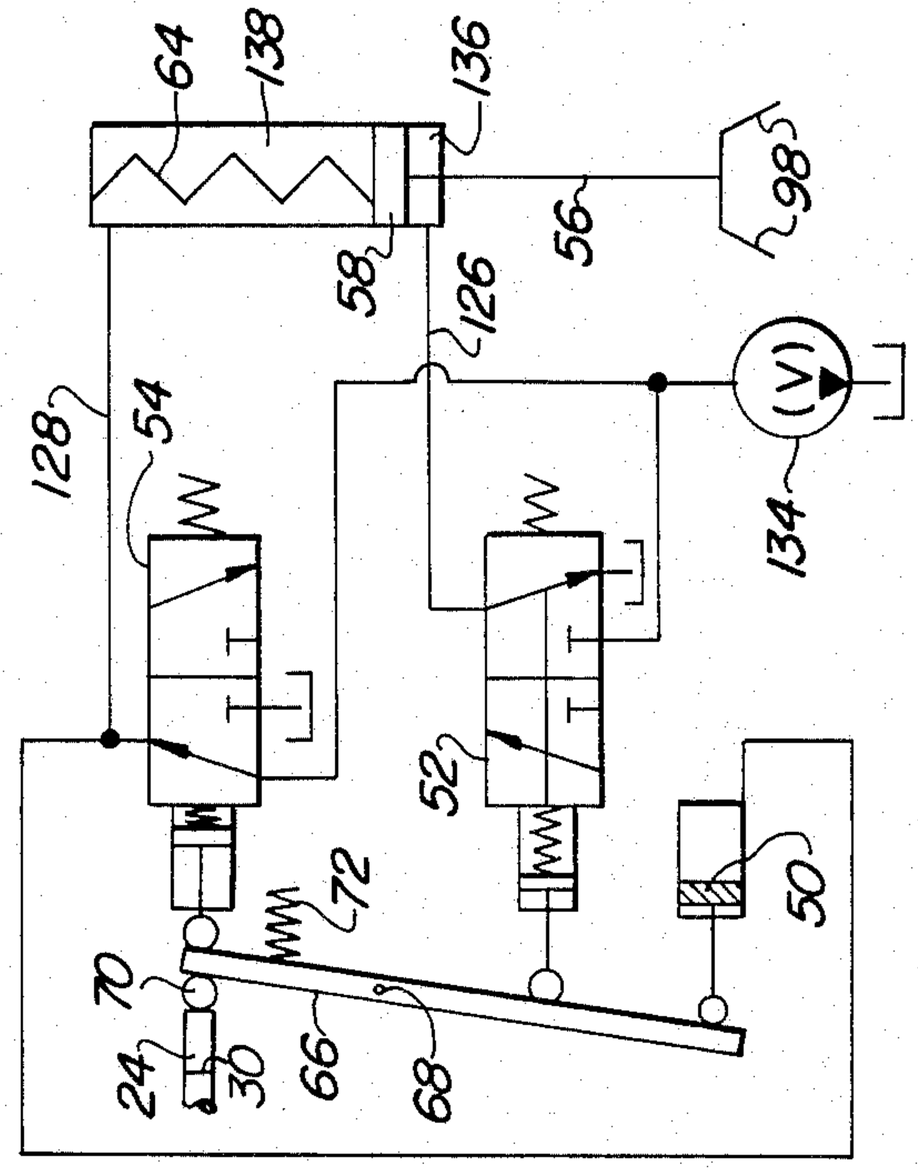
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Fig. 15

CAPPING HEAD

FIELD OF THE INVENTION

This invention relates to a capping head for screwing prethreaded closures onto containers provided with a screw thread.

BACKGROUND OF THE INVENTION

Various forms of capping heads are currently on the market for applying plastic and aluminum closures onto containers. Until recently, non-threaded closures were inserted onto the neck of a container and a capping head came down and formed the closure to the shape of the bottle's neck. With the advent of plastic closures, it became possible to mold the threads into the closure such that it was no longer necessary to form the closure on the container's neck. With prethreaded closures, it became customary to place the closure on the container's neck and then move the container into alignment with a capping head which would come down, contact the closure, and screw it onto the container. The closure would be tightened to a predetermined desired torque by a non-frictional magnetic clutch which was located between the chuck and the quill portion of the capping head. See U.S. Pat. Nos. 4,364,218 and 4,492,068, and U.S. Ser. No. 602,237, filed Apr. 19, 1984 and assigned to Aluminum Company of America. Such capping heads worked satisfactorily provided the prethreaded closure was initially placed squarely upon the container's neck. Problems would occur, however, when the closure was cocked or angled relative to the container's neck. In such situations, the threads on the screw closures were susceptible to cross-threading or the closures would not be tightened satisfactorily before the magnetic clutch disengaged.

Now a capping head has been invented which places a prethreaded closure squarely on a prethreaded container and tightens it down to a predetermined torque value.

SUMMARY OF THE INVENTION

Briefly, the present invention relates to a capping head which is designed to screw prethreaded closures onto containers provided with a screw thread. The capping head is designed to grip a prethreaded closure and position it over the neck portion of a container and screw the closure onto the container. The capping head includes a housing adapted to be secured to a rotatable spindle and having a quill mounted therein which is free to rotate with respect to the housing. The quill contains a pair of radially aligned poppet valves and an activating arm pivotally attached between the poppet valves. One end of the activating arm carries a cam follower which contacts a cam surface formed on the inside surface of the housing. The capping head also includes a clutch having a drive plate connected to the housing and a driven plate connected to the quill. Further attached to the driven plate is a chuck for gripping a prethreaded closure. The chuck is fluid activated between opened and closed positions by operation of the poppet valves. When the torque between the drive plate and the driven plate exceeds a desired predetermined value, the cam follower traverses the cam surface and selectively activates one of the two poppet valves, which in turn routes pressurized fluid through the quill to activate the chuck.

The general object of this invention is to provide a capping head. A more specific object of this invention is to provide a capping head which will screw prethreaded closures onto containers provided with screw threads.

Another object of this invention is to provide a capping head which will screw prethreaded closures onto containers at a faster speed than conventional capping heads.

Still further, an object of this invention is to provide a capping head which initially grips a prethreaded closure and positions it over the neck portion of a container before the closure is screwed onto the container.

A further object of this invention is to provide a capping head which will screw prethreaded closures onto the neck portions of containers at uniform torque values.

Other objects and advantages of the present invention will become more apparent to those skilled in the art in view of the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1***a* and **1***b* are upper and lower sectional views, respectively, of a capping head containing a finger gripping chuck, a magnetic torque-dependent clutch and a quill containing poppet valves which are selectively activated by an activating arm and cam arrangement.

FIG. **2** is a top view of a cam used in the capping head.

FIG. **3** is a side view of the cam taken along the line **3—3** in FIG. **2**.

FIG. **4** is an end view of the four gripper fingers in a closed position taken along line **4—4** of FIG. **1***b*.

FIG. **5** is a cross-sectional view of the quill showing the internal passages to the poppet valves.

FIG. **6** is a sectional view taken along line **6—6** of FIG. **5**.

FIG. **7** is a cross-sectional view of the quill and the second piston showing the internal passages between the poppet valves and the first and second pistons.

FIG. **8** is a sectional view of the quill taken along line **8—8** of FIG. **7**.

FIG. **9** is a cross-sectional view of the quill showing the exhaust passageways.

FIG. **10** is an end view of FIG. **9**.

FIG. **11** is a schematic of the fluid flow path between the poppet valves and the pistons showing the fingers of the chuck in an open position and the upper chamber of the second piston open to an exhaust passage.

FIG. **12** is a schematic of the fluid flow path between the poppet valves and the pistons showing the fingers of the chuck in a closed position.

FIG. **13** is a schematic of the fluid flow path between the poppet valves and the pistons showing the fingers of the chuck in a position to start releasing a prethreaded closure.

FIG. **14** is a schematic of the fluid flow path between the poppet valves and the pistons showing the fingers of the chuck in an open position and the lower chamber of the second piston open to an exhaust passage.

FIG. **15** is a schematic of the fluid flow path between the poppet valves and the pistons showing the fingers of the chuck in an open position and the upper chamber of the second piston vented to the atmosphere via the second poppet valve.

FIG. **16** is a schematic of the fluid flow path between the poppet valves and the pistons showing the fingers of

the chuck in an open position and the lower chamber of the second piston vented to the atmosphere via the first poppet valve.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1***a* and **1***b*, a capping head **10** is shown having a housing **12** adapted to be secured to a rotatable drive spindle **14**. The drive spindle **14** contains screw threads **16** which engage in a mounting hub **18** secured to one end of the housing **12**. The housing **12** contains an axial bore **20** which has an open end **22** aligned opposite to the mounting hub **18**. The housing **12** also has a cam member **24** attached thereto, see FIGS. **1***a*, **2** and **3**. The cam member **24** is shown as a separate part which mounts to the housing **12** by a plurality of bolts **26**. The bolts **26** are received in bores **28** formed in the cam member **24**. It should be noted that the cam member **24** can be integrally formed with the housing **12** if desired. The cam member **24** has a cam surface **30** which includes at least one and preferably four raised notches **32**. The notches **32** activate a cam follower which traverses the cam surface **30**. The exact number of notches which can be used and the spacing between the notches direct the movement of the cam follower and can be varied to suit one's particular needs.

The housing **12** has a quill **34** mounted therein on a pair of bearings **36** and **38**. The bearings **36** and **38** permit the quill **34** to rotate freely with respect to the housing **12**. The bearing **36** is press-fitted into an inner peripheral surface of the housing **12** while the bearing **38** is held in place by a bearing cap **40** and a retainer ring **41**. The bearing cap **40** is connected to the housing **12** by the bolts **26** which passed through the bores **28** formed in the cam member **24**.

The quill **34** contains three radial bores **42**, **44** and **46**, which are arranged in line along the longitudinal axis of the quill **34**, and a coaxial bore **48** which is opened at one end. The open end of the bore **48** is adjacent to the open end **22** of the housing **12**. A first piston **50** is movably positioned in the radial bore **42** and is biased outwardly by pressurized fluid, preferably air. Movably positioned in the bores **44** and **46** are first and second poppet valves **52** and **54**, respectively, which are biased outwardly by spring force. Preferably, the poppet valves **52** and **54** are 3-way, 2-position poppet valves. An elongated piston rod **56** is movably positioned in the coaxial bore **48** and has a second piston **58** secured thereto. The piston rod **56** is also movable by pressurized fluid, such as air, relative to the quill **34**. In order to permit pressurized air to be routed to the lower surface of the second piston **58**, a passageway **60** is formed through the piston rod **56** which terminates at a circumferentially located port **62** situated on the lower side of the second piston **58**. A spring **64** is positioned in the coaxial bore **48** between the quill **34** and the upper surface of the second piston **58** and serves to bias the second piston **58** away from the quill **34**. As used throughout this application, upper and lower surfaces will refer to the orientation of the capping head **10** as viewed in FIGS. **1***a* and **1***b*.

Referring again to FIG. **1***a*, the quill **34** has an activating arm **66** pivotally attached thereto by a bolt **68** such that the arm **66** can selectively operate either the first or second poppet valve **52** or **54**, respectively. The bolt **68** is threaded into a threaded bore **69** which is preferably formed in the quill **34** between the bores **44** and **46**. Attached to one end of the arm **66** is a cam follower **70** which is in constant contact with the cam surface **30**. To assure that the constant contact is maintained, a spring **72** is positioned close to the cam follower **70** in a shallow bore **74** formed in the quill **34**. The spring **72** biases the arm **66** outward away from the quill **34**. The opposite end of the arm **66** contacts the first piston **50** and controls its outward movement. When the cam follower **70** moves inward toward the center of the quill **34** by rolling over one of the notches **32**, the arm **66** pivots on the bolt **68** and permits the first piston **50** to move outward under the influence of pressurized air. The specific movements of the poppet valves **52** and **54** and the pistons **50** and **58**, relative to the position of the cam surface **30**, will be explained shortly.

Referring to FIG. **1***b*, the capping head **10** employs a torque dependent clutch **76** which is preferably a non-frictional magnetic clutch. The clutch **76** consists of a drive plate **78** which is attached to the bearing cap **40** by threads **80**. The threads **80** permit axial adjustment of the drive plate **78** relative to both the housing **12** and the bearing cap **40**. The clutch **76** also has a driven plate **82** which is permanently attached over the opened end of the quill **34** by machine screws **84**. Preferably, an inner circumferential surface **85** of the driven plate **82** provides a bore within which the second piston **58** can reciprocate. The driven plate **82** also serves as a stop to limit the downward movement of the second piston **58** away from the quill **34**.

Both the drive plate **78** and the driven plate **82** contain a plurality of cylindrical permanent magnets **86** and **88**, respectively, which are arranged in a circumferentially spaced relationship. The magnets **86** and **88** are mounted on facing surfaces of the drive plate **78** and the driven plate **82**, and the poles of the magnets **86** and **88** are arranged so that the drive plate **78** and the driven plate **82** attract each other at least in one relative position. There are an even number of magnets **86** and **88** arranged alternately in a north-south pole relationship. In our capping head **10**, eight magnets **86** are secured to the drive plate **78** and eight equal strength magnets **88** are secured to the driven plate **82**. When eight facing magnets **86** and **88** are used, four stable pole positions are created in a 360° revolution when the north poles on the magnets **86** coaxially align with the south poles on the magnets **88**. For each such alignment, a notch **32** must be present on the cam surface **30**. This can be accomplished by providing a plurality of notches **32** on the cam surface **30** numbering equal to half the number of magnets **86** on one of the plates **78** or **82**. For example, when four notches **32** are equally spaced on the cam surface **30** corresponding to eight magnets **86** in each of the plates **78** and **82**, the travel of the cam follower **70** will be 90° for each prethreaded closure **118** to be screwed onto a container.

The clutch **76** can be set to a desired, predetermined torque by controlling the air gap between the permanent magnets **86** and **88**. In the embodiment shown in FIG. **1***b*, this is easily accomplished by screwing the drive plate **78** further onto the bearing cap **40** when one wishes to increase the torque value and by unscrewing the drive plate **78** from the bearing cap **40** when the torque value is to be reduced. When the torque value between the drive plate **78** and the driven plate **82** is substantially below the preselected value, the drive plate **78**, the housing **12**, the driven plate **82** and the quill **34** will all rotate at the same speed and in the same direction as the drive spindle **14**. As the torque value between the plates **78** and **82** approaches the preselected

torque value, slippage occurs and the driven plate **82** and the quill **34** will begin to rotate at a slower speed than the housing **12**. When this occurs, the cam follower **70** will start to traverse the cam surface **30**. Once the desired torque value is reached or exceeded, the driven plate **82** and the quill **34** will stop rotating and this permits the cam follower **70** to traverse a greater segment of the cam surface **30**. The activating arm **66** will in turn pivot once the cam follower **70** encounters one of the notches **32**. The use and performance of magnetic clutches is described in U.S. Pat. No. 4,364,218 and also in U.S. Ser. No. 602,237, filed Apr. 19, 1984, assigned to Aluminum Company of America, both of which are incorporated by reference and made a part hereof.

A chuck **90**, which includes a support **92** and a guide ring **94**, is attached to an outer end of the driven plate **82** by cap screws **96**. The chuck **90** also includes a plurality of gripper fingers **98**, of which there are at least two and preferably four, each having a concave gripping surface **100**, best seen in FIG. **4**. Each finger **98** contains a flat pie-shaped base **102** which is pivotally retained between the guide ring **94** and a support nut **104**. The support nut **104** is secured to the outer end of the piston rod **56** by threads **106**. The support nut **104** contains a circumferential groove **108** on its outer periphery which has a tapered surface **110** angled downward and outward toward the driven plate **82**. The circumferential groove **108** receives the inner end of the base **102** of each finger **98** and permits the base **102** to pivot relative to the guide ring **94** as the support nut **104** is moved axially downward away from the quill **34**. Each gripper finger **98** also contains an inwardly extending tab **112** distally spaced from the base **102**. The tabs **112** cooperate with the support nut **104** to hold a pressure plate **114** in place. The tabs **112** project into a circumferential slot **116** formed in the outer periphery of the pressure plate **114**. The pressure plate **114** is preferably constructed of plastic or hard rubber and can act as a cushion and rest for the top of a prethreaded closure **118**. When four gripper fingers **98** are used, it is advantageous to arrange the fingers **98** in a circular pattern with each finger **98** being offset 90° from the adjacent fingers.

The chuck **90** is constructed such that as the piston rod **56** and the attached support nut **104** move axially downward away from the quill **34**, the gripper fingers **98** will pivot on the guide ring **94** to an open position. In the open position, the chuck **90** will be capable of receiving the prethreaded closure **118** within the opening defined by the concave gripping surfaces **100**. Movement of the piston rod **56** and support nut **104** axially upward toward the quill **34** will cause the gripper fingers **98** to pivot on the guide ring **94** to a closed position wherein the concave gripping surfaces **100** will grip the outside surface of the prethreaded closure **118**. In this position, the prethreaded closure **118** will be held secure with its outer top surface **119** contacting the pressure plate **114**. The prethreaded closure **118** will rotate at the same speed as the driven plate **82** and the quill **34**.

Referring to FIGS. **5** and **6**, pressurized air of approximately 50 to 125 pounds per square inch is supplied from a supply source (not shown) through a central passage **120** formed in the quill **34**. The incoming air is directed through two smaller passages **122** and **124** and is routed to the first and second bores **44** and **46**. The first and second bores **44** and **46** house the first and second poppet valves **52** and **54**, respectively. In this particular embodiment, the two passages **122** and **124** are used to guarantee that the first and second poppet valves **52** and **54**, respectively, receive an adequate volume of pressurized air. However, depending upon the application, one air passage may be sufficient. Furthermore, the air passage could have a larger diameter or the diameter could be kept the same if the required air volume was less.

Referring to FIGS. **7** and **8**, the pressurized air which enters the first and second bores **44** and **46** passes through the poppet valves **52** and **54** and is routed onto the first and second pistons **50** and **58**, repsectively, through passages **126** and **128**. The pressurized air from bore **44** is routed through passage **126** to the upper end of the piston rod **56**. This air then passes through the passageway **60** and the port **62** and impinges upon the lowermost surface of the second piston **58**. This pressurized air causes the second piston **58** to move upward toward the quill **34** which in turn causes the gripper fingers **98** to move to their closed position. At this time, the second poppet valve **54** will move to a position permitting air in the coaxial bore **48** and above the second piston **58** to be routed back through the passage **128** and into the second bore **46**. Also, pressurized air which is used to hold the first piston **50** in an out position can be vented through the same passage **128** to the second bore **46**. The air that is to be vented from the first and second bores **44** and **46**, respectively, is routed through exhaust passages **130** and **132** to the atmosphere as is shown in FIGS. **9** and **10**. It should be noted that the passages **126** and **128**, shown in FIGS. **7** and **8**, serve to alternatively supply and vent pressurized air to and from the upper and lower surfaces of the second piston **58**. The passage **128** also supplies and vents air to and from the first piston **50**. Therefore, the position of the first and second pistons **50** and **58**, respectively, will depend upon the position of the first and second poppet valves **52** and **54**, respectively, relative to their positions in the bores **44** and **46**. For example, when the second poppet valve **54**, located in the bore **46**, is positioned such that pressurized air can flow through the passage **128**, the first piston **50**, located in the bore **42**, will be biased outwardly. Simultaneously, pressurized air will enter the coaxial bore **48** and cause the second piston **58** to move downward away from the quill **34**. The downward movement of the piston **58** forces the air below the second piston **58** out through the port **62**, the passageway **60** and the passage **126** back through the first poppet valve **52** and through the exhaust passage **130** to the atmosphere. This permits further downward movement of the second piston **58** such that the gripper fingers **98** will pivot to their open position.

OPERATION

The operation of the capping head **10** will be explained by use of schematics shown in FIGS. **11–16**. Referring to FIG. **11**, the first poppet valve **52** is shown in an in position and the second poppet valve **54** is shown in an out position such that the arm **66** and cam follower **70** are biased against the cam member **24**. This figure represent the start position wherein the gripper fingers **98** are open and the second piston **58** is in a down position biased by the spring **64**. The system is currently at zero pressure since an air valve **134** is in a closed position and the passage **128** is open to the atmosphere via the second poppet valve **54**. At this time the capping head **10** is in a down position ready to grip a prethreaded closure **118** before it moves up and over into alignment with the neck of a bottle.

Referring to FIG. **12**, the air valve **134**, which can be an air valve as described in U.S. Ser. No. 792,500, filed on Oct. 29, 1985, and assigned to Aluminum Company of America, is opened and the air pressure is brought up to a pressure ranging between 50 and 125 psi. This air pressure is directed to the lower surface of the second piston **58** causing it to move upward against the spring **64** and close the fingers **98** about a prethreaded closure **118**. As pressurized air is routed through the first poppet valve **52** and the passage **126** to a lower chamber **136** of the cylinder, the air in an upper chamber **138** of the cylinder is vented through the passage **128** and through the second poppet valve **54** to the atmosphere. One will notice that the poppet valves **52** and **54** have not changed positions from FIG. **11** to FIG. **12**, but instead the only difference is that pressurized air has entered the system through the air valve **134** and the second piston **58** has moved upward causing the fingers **98** to close and grip the closure **118**. At this time the capping head **10** also moves vertically upward and in a circular arc into alignment with a prethreaded container which is to be capped. The prethreaded closure **118** is then lowered into contact with the neck of the container.

Referring to FIG. **13**, as the closure **118** is tightened onto the prethreaded container, the torque value exerted on the quill **34** increases to a point wherein the quill **34** stops rotating relative to the housing **12**. When this occurs, the cam follower **70** traverses the cam surface **30** and encounters one of the notches **32** formed thereon. The notch **32** forces the cam follower **70** to move inwardly toward the quill **34** which causes the arm **66** to pivot on the bolt **68**. This causes the second poppet valve **54** to move inward. At the same time, the arm **66** moves away from the first poppet **52** which is spring biased to move outward. The mechanical shift of the two poppet valves **52** and **54** causes the pressurized air from the air valve **134** to be routed to the inner surface of the first piston **50** via the extension of the passage **128**. This causes the piston **50** to move outward against one end of the arm **66**. In this position, the arm **66** is prevented from pivoting back to its initial position shown in FIG. **11**.

Referring now to FIG. **14**, the pressurized air from the air valve **134** is routed through the second poppet valve **54** and through the passage **128** to the upper chamber **138** of the second piston **58**. At the same time, the air in the lower chamber **136** is permitted to vent through the passage **126** and the first poppet valve **52** to the atmosphere. This flow path allows the second piston **58** to move downward under the influence of the pressurized air entering the upper chamber **138** in cooperation with the mechanical spring **64**. The downward movement of the second piston **58** causes the fingers **98** to open. At this time the capping head **10** is still in the down position with the chuck **90** positioned adjacent to the neck of the prethreaded container. Once the fingers **98** release the closure **118**, the quill **34** finds its next preferred position, determined by the magnets **86**. Also, the arm **66** rotates past the notch **32**. Air pressure in the passage **128** holds the piston **50** outward against the arm **66** which holds the second poppet valve **54** in position to keep fingers **98** open.

Referring to FIG. **15**, the supply of pressurized air to the system is terminated and the air valve **134** is moved to a position wherein it vents the air to the atmosphere. When this occurs, the pressurized air holding the first piston **50** outwardly and the pressurized air from the upper chamber **138** of the second piston **58** is released through the second poppet valve **54** and through the air valve **134**. At this time, the capping head **10** is still in the downward position but the container which has been capped has been routed away. It should be noted that even though the system is vented, the second piston **58** is still in the downward position causing the fingers **98** to remain open under the influence of the mechanical spring **64**. This is important for it assures that if the prethreaded closure **118** was defective, or if the threads were stripped during the threading process, or if there was a broken bottle under the chuck **90**, the closure **118** would still be allowed to drop out. This action clears the fingers **98** so they can pick up another prethreaded closure **118** for the next container. As the air pressure behind the first piston **50** is vented to the atmosphere, the spring **72** will cause the arm **66** to pivot back to its initial position. As this occurs, the first poppet valve **52** will be urged back to its inward position by the arm **66**, and the second poppet valve **54** will be moved outward under the influence of its biasing spring. This final position is shown in FIG. **16**. The capping head **10** will then vertically move upward and in a circular arc so as to be in position to pick up another prethreaded closure **118** and to thread it onto another container.

While the invention has been described in conjunction with a specific embodiment, it is to be understood that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the aforegoing description. Accordingly, this invention is intended to embrace all such alternatives, modifications and variations which fall within the spirit and scope of the appended claims.

We claim:

1. A capping head comprising a housing adapted to be secured to a drive spindle, a quill mounted in said housing for free rotation therewith and containing a pair of poppet valves, a torque-dependent clutch having a drive plate connected to said housing and a driven plate connected to said quill, a chuck capable of gripping a prethreaded closure attached to said driven plate and fluidly activated between an open and a closed position by said poppet valves, activating means attached to said quill and cooperating with said housing to selectively operate said poppet valves when the torque value between said drive plate and said driven plate exceeds a predetermined value, and conduit means for routing pressurized fluid to and from said poppet valves.

2. The capping head of claim **1** wherein said activating means includes an arm pivotally attached to said quill so as to selectively activate one of said poppet valves, and a cam follower attached to an end of said arm which contacts a cam formed on an inner circumferential surface of said housing.

3. The capping head of claim **2** wherein said poppet valves are arranged longitudinally in-line on said quill in radial bores and said arm is pivotally connected between said pair of poppet valves.

4. The capping head of claim **1** wherein said poppet valves are 3-way, 2-position valves.

5. A capping head for screwing a prethreaded closure onto a container, said capping head comprising:

(a) a housing adapted to be secured to a rotatable drive spindle and having a cam formed on an inner circumferential surface thereof;

(b) a quill mounted in said housing for free rotation therewith, said quill containing a pair of radially aligned poppet valves;

(c) a torque-dependent clutch having a drive plate secured to said housing and a driven plate secured to said quill, said clutch being capable of stopping the screwing of a screw closure onto said container when a predetermined desired torque is reached;

(d) a chuck secured to said driven plate for rotation therewith and being fluidly connected to said poppet valves for movement between a closed position whereby said screw closure is gripped and an open position whereby said screw closure is released;

(e) activating means for selectively operating said poppet valves by traversing said cam when the torque between said drive plate and said driven plate exceeds a predetermined value; and

(f) conduit means for routing pressurized fluid to and from said poppet valves.

6. The capping head of claim **5** wherein said activating means includes an arm pivotally attached to said quill so as to selectively activate one of said poppet valves and a cam follower attached to an end of said arm which contacts said cam.

7. The capping head of claim **5** wherein said arm is spring biased to ensure that said cam follower engages said cam.

8. The capping head of claim **5** wherein said clutch is a non-frictional clutch with permanent magnets mounted on facing surfaces of said drive plate and said driven plate, and the poles of said magnets are arranged so that said drive plate and said driven plate attract each other at least in one relative position.

9. The capping head of claim **5** wherein said chuck is comprised of at least two gripper fingers.

10. The capping head of claim **5** wherein said poppet valves are 3-way, 2-position valves.

11. A capping head for screwing a prethreaded closure onto a container provided with a screw thread, said capping head comprising:

(a) a housing adapted to be secured to a rotatable drive spindle having a bore formed therein which is open at one end and having a cam formed on an inner circumferential surface thereof:

(b) a quill mounted in said housing for free rotation therewith, said quill having two radial bores formed therein which receive a first and a second poppet valve, respectively, and a coaxial bore formed therein which is open at one end;

(c) a non-frictional, torque-dependent clutch which stops screwing a screw closure onto said container when a predetermined desired torque is reached, said clutch having a drive plate secured to said housing adjacent to said open end and a driven plate secured to said quill, said drive plate and said driven plate having permanent magnets on facing surfaces thereof which are retained in a spaced-apart relationship;

(d) a piston rod partially positioned in said coaxial bore formed in said quill and axially movable by pressurized fluid, said piston rod supporting a piston;

(e) a chuck secured to said driven plate for rotation therewith and affixed to an end of said piston rod for axial movement therewith, said chuck having a plurality of fingers which are movable between a closed position whereby a screw closure is gripped when said piston is pressurized on one side and an open position whereby said screw closure is released when said piston is pressurized on the opposite side;

(f) activating means for selectively operating said first and second poppet valves by traversing said cam when the torque between said drive plate and said driven plate exceed a predetermined value, said activating means including an arm pivotally attached to said quill and a cam follower attached to an end of said arm which contacts said cam; and

(g) conduit means for routing pressurized fluid to and from said first and second poppet valves and said piston.

12. The capping head of claim **11** wherein said pressurized fluid is air.

13. The capping head of claim **11** wherein said activating arm is pivotally attached between said first and second poppet valves.

14. The capping head of claim **13** wherein said arm is spring biased to ensure that said cam follower engages said cam.

15. The capping head of claim **11** wherein said piston is spring-biased to a position which causes said fingers to move toward said open position releasing said screw closure.

16. The capping head of claim **11** wherein said first and second poppet valves are 3-way, 2-position valves.

17. The capping head of claim **11** wherein said chuck has four fingers each having a concave gripping surface.

18. The capping head of claim **17** wherein said four fingers are arranged in a circular pattern with each finger being 90° out-of-phase with the adjoining fingers.

19. The capping head of claim **11** wherein said fingers are attached at their bases to a retainer ring which permits pivotal motion and said retainer ring is securely attached to said driven plate.

20. A capping head for screwing a prethreaded closure onto a container provided with a screw thread, said capping head comprising:

(a) a housing adapted to be secured to a rotatable drive spindle having a bore formed therein which is open at one end and having a cam formed on an inner circumferential surface thereof;

(b) a quill mounted in said housing for free rotation therewith, said quill having three radial bores formed therein which are arranged in-line and a coaxial bore formed therein which is open at one end, said bores retaining a first piston, a first poppet valve, a second poppet valve and a piston rod, respectively;

(c) a non-frictional, torque-dependent clutch which stops screwing a prethreaded closure onto said container when a predetermined desired torque is reached, said clutch having a drive plate secured to said housing adjacent to said open end and a driven plate secured to said quill, said drive plate and said driven plate having permanent magnets on facing surfaces thereof which are retained in a spaced-apart relationship;

(d) a second piston mounted on said piston rod and being movable by pressurized fluid relative to said open end of said quill;

(e) a chuck secured to said driven plate for rotation therewith and affixed to an end of said piston rod for axial movement therewith, said chuck having a plurality of fingers which are movable between a closed position whereby a prethreaded closure is gripped when said second piston is pressurized on one side and an open position whereby said prethreaded closure is released when said piston is pressurized on the opposite side;

(f) activating means for selectively operating said first and second pistons and said first and second poppet valves, said activating means including an arm pivotally attached to said quill, one end of said arm being in constant contact with said first piston and the other end of said arm having a cam follower attached thereto which traverses said cam when the torque between said drive plate and said driven plate exceeds a predetermined value; and

(g) conduit means for routing pressurized fluid to and from said first and second pistons and said first and second poppet valves.

21. The capping head of claim **20** wherein said arm is spring-biased outwardly such that said cam follower is in constant contact with said cam.

22. The capping head of claim **20** wherein said first and second poppet valves are 3-way, 2-position valves.

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